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NOMENCLATURE OF BREADFRUIT CULTIVARS IN SAMOA: SALIENCY, AMBIGUITY, AND MONOMIALITY

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ABSTRACT.—Breadfruit is an important subsistence crop in the Samoan archipelago, where numerous cultivars are grown and used. The diversity of breadfruit in Samoa is indicative of its antiquity and value to this society. The purpose of our study was to document and compare knowledge of breadfruit names by Samoans of a wide range of ages in both rural villages and towns and to test the relationship between saliency and binomiality. A total of 354 people were interviewed and 46 cultivar names were recorded. A binomial is used to name a breadfruit—the generic term ***'ulu*** is given first and a second word is added to describe that particular cultivar—when the second word used alone could refer to something other than breadfruit. A monomial is used only when this term does not refer to anything else or has no other meaning. There was no significant relationship between saliency and binomiality of breadfruit names and a significant relationship between binomiality and linguistic ambiguity. A useful outcome of this study was defining 60 Samoans as "experts" with statistical measures that we will use in continuing ethnobotanical studies in Oceania and that may have broader application.

Key words: breadfruit, *Artocarpus altilis*, Samoa, tropical crop cultivars, ethnotaxonomy.

RESUMEN.—El árbol del pan es un cultivo importante para la subsistencia en el archipiélago de Samoa, donde se cultivan y utilizan numerosas variedades. La diversidad de árboles del pan en Samoa es indicativa de su antigüedad y valor para esta sociedad. El propósito de nuestro estudio era documentar y comparar el conocimiento de los nombres de variedades de los árboles del pan entre Samoanos de una amplia gama de edades en aldeas y pueblos rurales y examinar la relación entre la importancia cultural y utilizacíon de binomios. Se entrevistó un total de 354 personas y se registran 46 nombres de variedades. Se utiliza un binomio para denominar un cultivar de árbol del pan—al término genérico ***'ulu*** y se le agrega una segunda palabra para describir ese cultivar particular—cuando al utilizar la segunda palabra sola podría entenderse algo distinto a los árboles del pan. Se utiliza un monomio solamente cuando este término no se refiere a ninguna otra cosa ni tiene ningún otro significado. No encontramos ninguna relación significativa entre la importancia cultural y la utilizacíon de binomios y la ambigüedad lingüística. Durante este estudio utilizamos medidas estadísticas

para definir a 60 Samoanos como "expertos." Esta técnica servirá para la continuación denuestros estudios ethnobotánicos en Oceanía y pueden tener una aplicación más amplia.

RÉSUMÉ.—L'arbre à pain demeure une espèce importante en agriculture de subsistance dans l'archipel de Samoa, où de nombreux cultivars sont utilisés et cultivés. La diversité de l'arbre à pain en Samoa est un indice de son antiquité et de son importance pour cette société. Le but de notre étude était de documenter et de comparer la connaissance portant sur les noms de l'arbre à pain parmi les Samoans provenant d'un large éventail d'âges et issus autant des villes que des villages ruraux. Le rapport entre l'importance culturelle et la binômialité a été vérifié. Un total de 354 personnes ont été interviewées et 46 noms de cultivars ont été enregistrés. Un binôme est employé pour désigner un arbre à pain: le terme générique «*'ulu*» est donné d'abord, puis un deuxième mot est ajouté pour décrire ce cultivar particulier. Le deuxième mot utilisé seul pourrait cependant se référer à autre chose que l'arbre à pain. Un monôme est employé seulement lorsque ce terme ne se rapporte pas à autre chose ou n'a aucune autre acception. Nous n'avons trouvé aucun rapport significatif entre l'importance culturelle et la binômialité des noms de l'arbre à pain, mais il existe un rapport significatif entre la binômialité et l'ambiguïté linguistique. Des mesures statistiques ont été utilisées afin de qualifier «experts» 60 Samoans. Cette approche nous sera utile lors de nos prochaines études ethnobotaniques en Océanie. Elle pourrait avoir de plus larges applications.

INTRODUCTION

Agricultural people throughout the world typically recognize and name numerous forms or varietals of important domesticated plant species. These folk specific taxa are typically distinguished by subtle morphological differences such as color, relative size, shape, habit of growth, etc. (Berlin 1992). Culturally salient plants—those species and cultivars that are well known throughout a culture and are easily recognizable—have been the subject of much discussion and debate (e.g., Atran et al. 1997; Berlin 1986, 1992; Brown 1985, 1986, 1987). It has been suggested that highly salient taxa should be named with a monomial (Berlin 1992), while the greater specificity possible in a binomial should be used to distinguish closely related taxa, especially cultivars of domesticated plants (Hays in Brown 1985). This idea is roughly analogous to the use of short telephone numbers in Western societies to refer to highly salient services, such as 911 for the Police or 411 for Information, while longer numbers are used to distinguish between the numerous Jones families that appear in the telephone directory.

In this paper, a data set of 350 interviews with Samoans concerning knowledge of breadfruit names is statistically analyzed. We wanted to see if there are general patterns in the names applied to breadfruit cultivars, such patterns being a component of folk taxonomy in general (Berlin 1992), in an effort to determine both consistency and hierarchical diversity in the folk nomenclature of breadfruit in Samoa.

The Samoan archipelago lies in the central south Pacific Ocean. It is divided into two political entities: the independent nation of Samoa (formerly Western Samoa, which changed its name in 1997) with the principal islands of 'Upolu and

FIGURE 1.—*Ma'afala,* a common Samoan breadfruit cultivar, growing by a residence in Saipipi Village, Savai'i. Photograph by Diane Ragone.

Savai'i, as well as two smaller inhabited islands, Manono and Apolima. The easternmost islands are part of American Samoa, an unincorporated territory of the United States, comprised of five inhabited volcanic islands (Tutuila, Aunu'u, and the Manu'a Group of Ofu, Olosega, and Ta'u), and two coral atolls (Swains Island and the uninhabited Rose Atoll).

Breadfruit, *Artocarpus altilis* (Parkinson) Fosberg (Moraceae), is an important subsistence food crop in Samoa and trees are grown around residences (Figure 1) in all villages and in the towns (Ragone 1997; Whistler 2000). A census in 1989 estimated that 89 percent of agricultural households grew breadfruit and an estimated single crop equivalent area of 1000 ha of land was in cultivation (Ward and Ashcroft 1998). An aboriginal introduction, breadfruit has been an important component of Samoan subsistence agriculture for more than three millennia as part of a suite of crops that includes coconuts (*Cocos nucifera* L.), bananas (*Musa* sp.), taro (*Colocasia esculenta* (L.) Schott and *Alocasia macrorrhiza* (L.) D. Don), yams (*Dioscorea* sp.), ***'ava*** (*Piper methysticum* Forst. f.), and sugarcane (*Saccharum officinarum* L.).

Names, and in some cases descriptions, for as many as 30 Samoan breadfruit cultivars have been recorded by various visitors to Samoa since the 1840s (Ragone 1995). Cultivars are recognized and distinguished based on various morphological characters such as fruit shape and size, skin texture, flesh color, presence of seeds, leaf shape (especially degree of dissection or lobing), and tree form, or by fruit attributes related to cooking or storage qualities (Ragone 1997). The purpose of this study was to document and compare knowledge of breadfruit names by

females and males of a wide range of ages in both rural villages and towns in Samoa. Our intent is to contribute not only to an understanding of breadfruit names in Samoa, but also to test the relationship between cultivar saliency and binomiality.

METHODS

Interview Techniques.—In July 2000, 354 Samoans in Samoa and American Samoa were interviewed about their knowledge of breadfruit names. Seven villages or towns were chosen for study: in independent Samoa, Saipipi and Falealupo on Savai'i and Apia (the capital city) on 'Upolu; and in American Samoa, Olosega and Ofu, Manu'a Group, Pago Pago (the capital city) and Afono on Tutuila Island. The interviews were conducted in the Samoan language by two-person teams and the responses were recorded on a standard form. In each village the teams walked to dwellings and work areas, interviewing any person who agreed to be interviewed. Interviews were conducted in homes, markets, and other areas of work and transit in the towns. In addition to residents, several expatriate Samoans from New Zealand and the United States who were visiting their families were interviewed. The age, date and place of birth, gender, occupation, place of residence, and marital status of each person interviewed were recorded. Each person was asked to name as many different cultivars of breadfruit as they could, together with information about local availability of each cultivar. The names were then read back to the respondent to ensure accuracy and to provide them with the opportunity to add any additional names.

One group interview with 43 Samoan chiefs (***matai***) was conducted during a chief's council meeting after an ***'ava*** ceremony in Falealupo, Savai'i. In addition, 16 individuals in Apia with conservation management responsibilities in government or NGOs (nongovernmental organizations) were interviewed. The latter 16 interviews were not pooled with the rest of the data to allow a comparison between the two data sets.

Several of the respondents, particularly those deemed by our statistical procedures to be "experts" (see below), were interviewed at length to elicit detailed information about uses, cultivation practices, descriptions, and naming rules or patterns of rules used to name breadfruit cultivars, but these data are not reported here. Voucher specimens of breadfruit cultivars were collected and deposited at the National Tropical Botanical Garden (PTBG).[1]

Recording of Data; Definitions of Idiosyncratic and Expert Respondents.—Interview data were entered into a spreadsheet on a portable computer in the field and grouped according to village. The breadfruit cultivar names recorded in the interviews were ranked by order of frequency of mention (Table 1). Breadfruit names in Samoa consist of either a binomial composed of a generic level term ***'ulu*** modified by a specific epithet or a monomial in which only the specific level epithet is used and ***'ulu*** is understood. If there was variation in the binomial or monomial form of a breadfruit cultivar name, e.g., ***ma'afala*** and ***'ulu ma'afala***, the form used by the majority of the respondents was selected. Where there were slight differences in spellings or pronunciations, a standardized spelling/pronunciation used by the

TABLE 1.—Frequency of breadfruit cultivar names recorded during interviews with 350 Samoans.

Cultivar name	Number of respondents[a]		%	Rank[b]	Type of name[c]	Translation[d]
ma'afala	(308)	315	90	1	UM	—
'ulu ma'afala	(7)					
puou	(283)	286	81	2	UM	—
'ulu puou	(3)					
aveloloa		238	68	3	UM	—
maopo	(214)	218	62	4	UM	—
'ulu maopo	(4)					
'ulu ma'a		195	56	5	AB	rock, hard[3]
'ulu ea	(185)	194	55	6	AB	Uvea Island[2]
'ulu uea	(9)					
'ulu manu'a		131	37	7	AB	Manu'a Islands[2]
momolega		116	33	8	UM	egg yolk[1]
'ulu sina	(79)	80	22	9	AB	white[1]
'ulu asina	(1)					
sagosago	(55)	59	17	10	UM	—
'ulu sagosago	(4)					
peti	(42)	56	16	11	AM	fat[1]
'ulu peti	(14)					
'ulu tala	(51)	54	15	12	AB	spiny[1]
'ulu talatala	(3)					
fia puou	(34)	38	11	13	UM	wants to be a ***puou***[4]
fa'a fia puou	(3)					
'ulu fia puou	(1)					
'ulu fefelo	(22)	33	9	14	UB	—
fefelo	(11)					
'ulu initia		29	8	15	AB	India breadfruit[2]

TABLE 1—(continued)

Cultivar name	Number of respondents[a]		%	Rank[b]	Type of name[c]	Translation[d]
'ulu fau		26	7	16	AB	fibrous[3]
mase'e	(21)	23	7	17	UM	—
'ulu mase'e	(2)					
'ulu se'e		19	5	18	AB	sliding[3]
'ulu kiripati/kilipati		11	3	19.5	AB	Gilbert Islands[2]
gutufagu	(9)	11	3	19.5	UM	neck of the bottle[1]
'ulu gutufagu	(2)					
puou fatu		10	3	21	UM	seedy *puou*[1]
'ulu falaoa		8	2	22	AB	loaf of bread[1]
vasivasi	(5)	6	1	23	UM	—
'ulu vasivasi	(1)					
puou tala		5	1	24	UM	spiny *puou*[1]
'ulu fiti		4	1	26	AB	Fiji[2]
tui tu		4	1	26	AM	spiny[1]
fia maopo		4	1	26	UM	wants to be *maopo*[4]
puou maopo		3	1	28.5	UM	*puou* that looks like *maopo*[4]
maualuga		3	1	28.5	AM	high[5]
'ulu faga		2	1	31	AB	eel trap[1]
malali		2	1	31	AM	smooth[1]
matatetele	(1)	2	1	31	AM	big eye[1]
'ulu matatetele	(1)					
ma'afala tala		1	0	39.5	UM	spiny *ma'afala*[1]
puou tutumu		1	0	39.5	UM	roasting *puou*[3]
'ulu toso		1	0	39.5	AB	pull[6]
'ulu to'elau		1	0	39.5	AB	Tokelau Islands[2]
'ulu tau		1	0	39.5	AB	pluck[6]

TABLE 1—(continued)

Cultivar name	Number of respondents[a]	%	Rank[b]	Type of name[c]	Translation[d]
'ulu sasalapa	1	0	39.5	AB	custard apple[1]
puou fefelo	1	0	39.5	AM	***puou*** that looks like ***fefelo***[4]
'ulu fagaloa	1	0	39.5	AB	Fagaloa village[2]
avesasa'a	1	0	39.5	UM	—
'ulu pase'e	1	0	39.5	AB	lazy[6]
'ulu mama	1	0	39.5	AB	light weight[3]
segatoa	1	0	39.5	UM	—
po'eloa	1	0	39.5	UM	—
fia ta	1	0	39.5	AM	wants to be slashed[6]

[a] Number of respondents (in parentheses) who listed a binomial or monomial variant of name.
[b] Ties are scored by using the average of the ranks of tied numbers, e.g., (19 + 20)/2 = 19.5, S(33:46)/14 = 39.5.
[c] Binomial/Monomial names as identified by Samoans. UM = unambiguous monomial, AM = ambiguous monomial, AB = ambiguous binomial, UB = unambiguous binomial.
[d] Definition of the different names of breadfruit cultivars. 1 = appearance, 2 = putative origin, 3 = culinary properties, 4 = comparative, 5 = respect term, 6 = descriptive action involving breadfruit. See text for explanation of categories.

TABLE 2.—Examples of Samoan breadfruit cultivar monomials and binomials.

	Generic term	Specific modifier
Binomial	*'ulu*	*sina*
Binomial with respect term	*fa'atau*	*sina*
Monomial	Ø	*ma'opo*
Monomial with two words in specific epithet	Ø	*fia puou*

Ø—generic term is understood.

majority of the respondents, e.g., *'ulu ea* and *'ulu uea,* was adopted.[2] In these cases, the names were scored together for statistical purposes.

Before analyzing the data, idiosyncratic responses and interviews were removed and expert respondents were identified. A breadfruit name was regarded as idiosyncratic if it was mentioned by only one respondent, unless that respondent was an expert as defined below. The interview of any respondent who mentioned two or more idiosyncratic taxa was also defined as idiosyncratic. Idiosyncratic names and interviews were excluded from the statistical analyses. An expert was defined as any individual who reported a number of breadfruit cultivars equal to or greater than one standard deviation above the mean number of names reported by all respondents, and whose reported names included 90% of the cultivars that were known by at least half of all respondents.

Each breadfruit name was scored as an ambiguous monomial (AM), unambiguous monomial (UM), ambiguous binomial (AB), or unambiguous binomial (UB). This was accomplished by comparing the name to two comprehensive dictionaries of the Samoan language (Milner 1966; Pratt 1911) and by checking with two bilingual speakers of English and Samoan. A name was regarded as ambiguous if it conceivably could refer to an object other than breadfruit. This concept of using the term *'ulu* to prevent ambiguity or misunderstanding was posited by one of the *matai*[3] when asked to explain how breadfruit cultivars are named and why some include the term *'ulu* and others do not. The example he gave to make this clear was, "If I ask one of the young men to 'Go get a *ma'a*' he'll probably bring back a stone, but if I say 'Go get an *'ulu ma'a*' he knows exactly what I'm asking for, whereas if I say 'Go get a *ma'afala*', it is absolutely clear that I want a certain type of breadfruit. It wouldn't be necessary to say 'Go get an *'ulu ma'afala*'." We here use the terms "ambiguous" and "unambiguous" as contrast terms rather than Berlin's (1992) terms of "analyzable/unanalyzable" for the sake of simplicity, and because "ambiguous" and "unambiguous" are direct translations of the Samoan terms "*manino*" and "*le manino*" respectively.

RESULTS

Interviews.—Breadfruit cultivar names in Samoa consist of either a binomial composed of the term *'ulu* modified by a descriptive term (Table 2), or a monomial in which only a descriptive term is used and *'ulu* is understood. This understanding was made explicit to us by several respondents, who, if questioned intensely or if they thought we were naive, would add the term *'ulu* to the description to emphasize that they were indeed referring to a cultivar of breadfruit. Samoan, as

is the case with many languages that did not have an indigenous orthography, often uses a series of two or more words to express a single concept. Consequently, monomials can also sometimes be expressed as several words that form a coherent epithet or descriptive phrase. All persons interviewed used the generic level term ***'ulu*** for breadfruit, with the single exception of the village of Tafua, Savai'i. Because the Samoan language of politeness taboos the use of a word if it is a chief's name, it may not be used in the presence of the chief holding the name as a title (Pratt 1911). Out of deference for the paramount chief 'Ulu Taufa'asisina, the respect word for breadfruit, ***fa'atau***, is always substituted for the term ***'ulu*** in this village.

There are several different categories of breadfruit names regardless of binomiality or monomiality. For example, one kind of name reflects the appearance of the breadfruit, such as ***'ulu sina*** 'white breadfruit', or ***momolega***, whose name evokes the yolk of an egg in reference to its very yellow flesh. Other names are geographical, reflecting the putative origin of the cultivar such as in ***'ulu manu'a*** 'Manuan breadfruit'. Another kind of breadfruit name reflects culinary properties, as in ***'ulu ma'a*** 'hard breadfruit', which takes a long time to cook. Yet other breadfruit names are comparative in the sense that they reflect overall similarities to another cultivar such as in ***puou maopo***, a '***puou*** that looks like ***maopo***'. Two minor categories are names that are respect terms such as ***maualuga***, which means high, or descriptive actions such as ***'ulu tau*** 'to pluck'. Lastly, eleven breadfruit names, such as ***aveloloa***, are irreducible in the sense that they either cannot be translated or their meaning has been forgotten by contemporary Samoans. The Samoan dictionary (Pratt 1911) defines these simply as "a variety or type of breadfruit."

Recording of Data; Definitions of Idiosyncratic and Expert Respondents.—Using the redacted data set (determined by excluding all idiosyncratic names and all four idiosyncratic interviews) and by combining monomial/binomial variants (using a majority rule) and cognates, a total of 46 different names for breadfruit cultivars were recorded during individual interviews with 350 Samoans. The effect of excluding these four interviews had only a small effect in the mean number of taxa reported (6.3 redacted, 6.4 unredacted) and no effect on the median number reported (6 names), with the number of breadfruit cultivars reported ranging from 0 to 20 names.

Of the 354 individuals who were interviewed, 63 respondents reported 10 or more names, which is one standard deviation above the mean number of names known to all informants. Three of these individuals were excluded as experts because they did not meet the second expert criterion: they did not know 90% of the cultivar names known to more than half of all respondents. Therefore, 60 individuals were defined as "experts." This statistical definition of expertise is compatible with Samoan folk perceptions of expertise. ***Tofa mamao***, which glosses as 'deep understanding', is not found in everyone, but all villagers know who has such 'deep understanding'. In several instances, respondents suggested that we speak with certain villagers because those individuals would know a lot about breadfruit, and this was borne out during in-depth interviews. These individuals had extensive knowledge of other practices concerning breadfruit such as crop

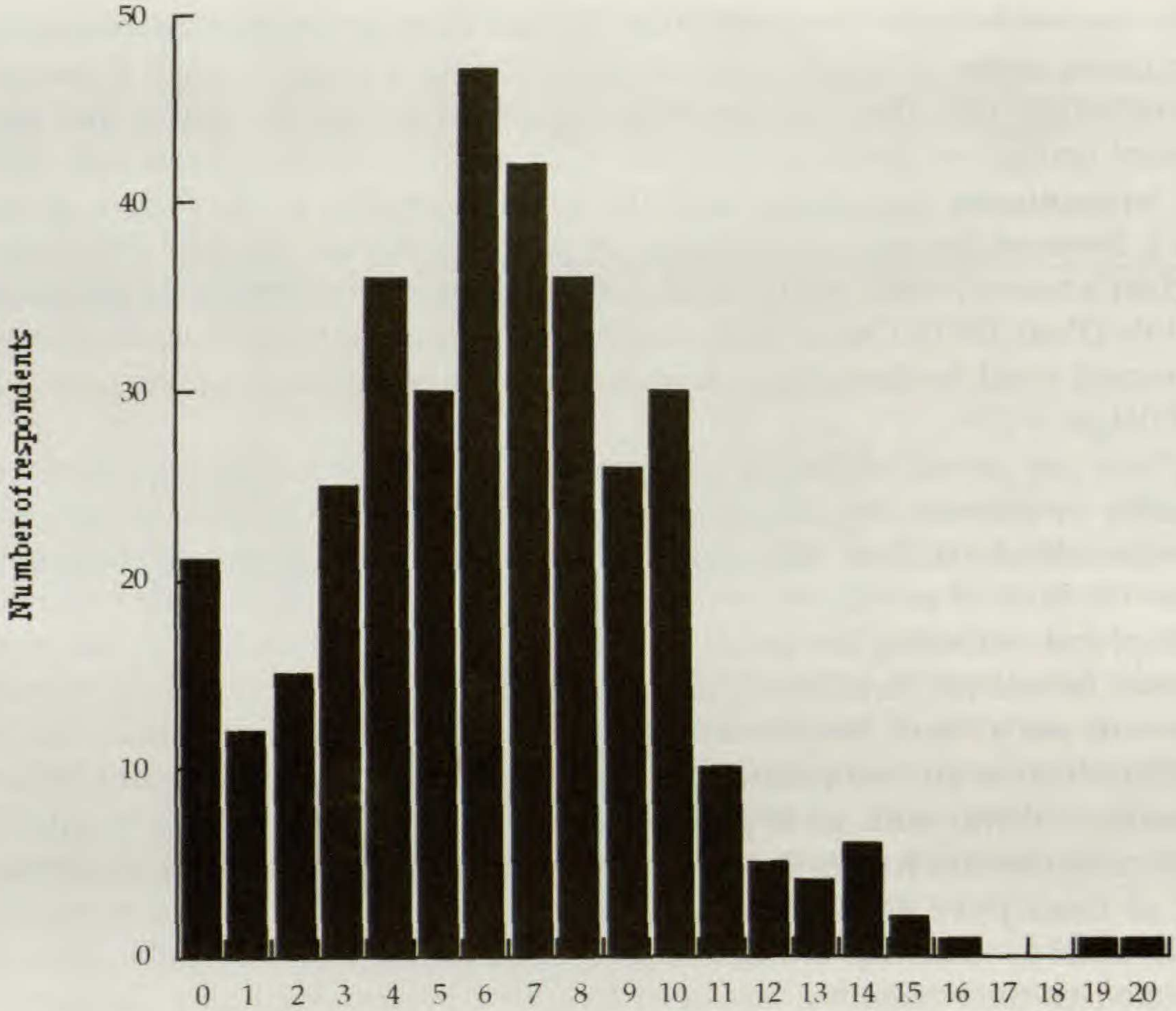

FIGURE 2.—Number of breadfruit cultivar names known by 350 Samoans.

husbandry, how to identify different cultivars, preferred uses, etc. The data are not normally distributed (Figure 2) and do not come from a random sample, so non-parametric statistics were used in the data analysis.

Binomiality, Saliency, and Linguistic Ambiguity.—Using the redacted data set (i.e., the entire data set less idiosyncratic interviews), we sought to study the possible relationship between the saliency of breadfruit names and their binomiality. The cultivar names listed in Table 1 were analyzed for prominence of binomial versus monomial ethnotaxa to see if monomials tended to be more salient.

H_0 = there is no relationship between binomiality and saliency
H_1 = there is a relationship between binomiality and saliency

were tested using a Wilcoxon rank sum test (Remington and Schork 1985; Snedecor and Cochran 1989) and testing at the 0.05 level for significance. Ties were scored by using the average of the ranks of tied numbers. The test statistic ($z = -0.83$) was not significant at the 0.05 level so hypothesis H_1 was rejected: there is no relationship between binomiality and saliency. To limit the influence of infrequent names, the two hypotheses were again tested with the Wilcoxon Rank-Sum using only the 66% most salient taxa. In this second test, H_1 was again rejected ($z = 0.74$). A third test, comparing only the top ten most salient names,

TABLE 3.—Summary of ambiguous and unambiguous binomial and monomial breadfruit cultivar names.

	Binomial	Monomial	Totals
Ambiguous	19 (11.3)	7 (14.7)	26
Unambiguous	1 (8.7)	19 (11.3)	20
Totals	20	26	46

Note: cells have number observed and (expected).

was performed, using a *W* statistic rather than *Z* because of the small sample size. In this third test, H_1 was rejected a third time, so we can unequivocally state that there is no significant relationship between saliency and binomiality in breadfruit names reported by 350 Samoans.

The hypotheses

H_0 = there is no relationship between ambiguity and binomiality
H_1 = there is a relationship between ambiguity and binomiality

were tested by constructing a 2 × 2 contingency table, with the columns representing monomial and binomial names and the rows representing linguistically ambiguous and unambiguous names (Table 3). A χ^2 statistic was calculated ($\chi^2 = 22.2$, $p < 0.001$) and tested at the 0.05 level for significance using Yates correction for continuity (Snedecor and Cochran 1989) and H_0 was rejected. Binomiality is significantly related to linguistic ambiguity among our 350 respondents. When Table 1 is analyzed for a relationship between linguistic ambiguity and saliency, the relationship is even stronger: 82% of all breadfruit names are either unambiguous monomials (UM) or ambiguous binomials (AB); e.g., binomials whose specific epithet alone, out of context, could conceivably refer to another object than breadfruit.

These results do not support the rather reasonable assertion by Berlin (1992) that monomials should be used to label highly salient taxa—indeed there is no relationship between saliency and monomiality—but our results do support the indigenous hypothesis that monomials should be used only when the terms are completely unambiguous.

Age, Gender, Westernization and Cultural Competency.—To determine if there was a relationship between age of the respondent and number of breadfruit names reported (Table 4), the median number of taxa reported by respondents in each of nine age classes was calculated (Class 1 = ages 0–9; Class 2 = ages 10–19; etc.). For statistical continuity age cohorts 0–9 and 80–89 were included; they indicate the age decade but do not imply that a 0 age child or an 89 year old adult were interviewed. The three youngest people interviewed were between two and four years old, all others were six years or older. The oldest person was 84 years old. These terms are merely labels for the cohorts. These data were used to test the following hypotheses:

H_0 = there is no relationship between age class and number of breadfruit names reported
H_1 = there is a relationship between age class and number of breadfruit names reported

TABLE 4.—Knowledge of breadfruit cultivar names based on age class.

Age class (years)	Respondents (n =)	Mean	Rank	Difference (D)	D^{2*}
1 (0–9)	14	1.4	9	−7.6	57.76
2 (10–19)	78	4.1	8	−3.9	15.21
3 (20–29)	78	6.1	7	−0.9	0.81
4 (30–39)	57	6.7	6	0.7	0.49
5 (40–49)	31	7.4	5	2.4	5.76
6 (50–59)	40	8.0	3	5.0	25.00
7 (60–69)	31	9.2	1	8.2	67.24
8 (70–79)	19	8.6	2	6.6	43.56
9 (80–89)	2	7.5	4	3.5	12.25

* Sum of $D^2 = 228.08$; $r = -0.90$.

by calculating a Spearman's rank correlation coefficient and testing for significance at the 0.05 level. Since at 7 ($n - 2$) degrees of freedom, the two-tailed significance level for the correlation coefficient r at the 0.01 probability is 0.798, H_0 is rejected, showing a strong relationship between age class and mean number of breadfruit taxa reported.

We wished to determine if the location of one's residence had any influence on the number of breadfruit names (Table 5) that were known as well as whether gender played a role in such knowledge. Ordinarily an analysis of variance would be used to see if such differences are important. Since these data are not randomly collected independent samples with normal distribution, and since sample variances were not equal for the subsamples, such an ANOVA analysis with the parametric F statistic would be inappropriate. Therefore the nonparametric Kruskal-Wallis test was used which generates a statistic comparable to that of an ANOVA to test using the χ^2 distribution at the 0.05 level of significance for the following hypotheses

H_0 = there is no difference between villages in the number of breadfruit names known

H_1 = villages differ in the number of breadfruit names known.

This test yielded an H statistic of 123.6. Since multiple ties occur in the data set, this statistic was corrected by dividing by the correction factor ($1 - (T^3 - T)/N^3 - N = 0.99$) where T is the number of ties for each observation and N is the sample size. Our corrected statistic $H_{corr} = 124.7$. At seven degrees of freedom, since H exceeds 203, H_0 at $p < 0.005$ was rejected, hence place of residence is highly significant in influencing number of breadfruit names known.

TABLE 5.—Knowledge of breadfruit cultivar names based on place of residence.

Number of names known	Ofu	Olosega	Afono	Pago	Apia	Falealupo	Saipipi	Expat.
Mean	5.1	5.3	5.5	5	5.6	7.5	8.7	1.6
Median	5	5	6	5	5.5	7	8	2
Maximum	10	11	11	11	11	14	20	4
Respondents (n =)	51	52	28	59	34	33	88	5

TABLE 6.—Knowledge of breadfruit cultivar names based on gender.

Number of names known	All females	All males	Expert females	Expert males
Mean	5.6	7.1	10.9	11.9
Median	6	7	10	11
Maximum	19	20	19	20
Respondents (n =)	192	158	23	37

Gender differences were also tested using the Kruskal-Wallis test. The hypotheses were:

H_0 = there is no difference between genders in the number of breadfruit names known

H_1 = men and women differ in the number of breadfruit names known.

For the total of 192 women and 158 men in our sample (Table 6), the corrected H statistic was 21.7, allowing us to reject H_0 at the $p < 0.005$ level: men know significantly more breadfruit names than women.

DISCUSSION

We were impressed by the diversity of breadfruit cultivars recognized by the Samoans in our sample. We are unaware of any major supermarket in the United States that stocks anything approaching this selection of crop diversity, which the Samoans claim grows in and about their villages. Our data set of 350 interviews allows us to do more than to document the richness of Samoan breadfruit diversity; it allows us to test several hypotheses about knowledge of breadfruit.

The five criteria of Brown (1985) are used in determining which Samoan breadfruit names are binomials or monomials: 1) a composite term is considered to be binomial if one constituent of the label stands on its own as the name of the class (e.g., *'ulu*); 2) one constituent is not a major life-form (e.g., breadfruit 'tree'); 3) morphologically dissimilar (i.e., sea horse is not a type of binomial); 4) shared generic constituent; and 5) composite terms 'mate of', 'like', 'similar' are not binomials. The suggestion that monomials are used in folk taxonomy to label highly salient folk taxa has been asserted for the simple reason that binomial names for lower-salience referents are overall less salient and more easily remembered than monomials (Brown 1985, 1986, 1987). Berlin (1986) argued that it is erroneous to state that the increase in binomial taxa results from an overall decrease in saliency. Rather it is due to direct biological manipulation by humans in the process of domestication and that folk genera with the largest numbers of folk species are always cultivated plants. Folk specific taxa may finely subdivide a single biological species with cultivated plants that have been highly modified under domestication (Berlin 1992). Hays (in Brown 1985) argued that "binomialization might be most common in sets of taxa that are *highly* salient; i.e., domesticated plants or animals of which varieties or species (binomially labeled) would have resulted from domestication." What is needed to test these competing hypotheses has been a direct indicator of saliency in a folk setting.

Frequency of mention in a standard interview as an index of saliency of a

folk taxon is adopted here. Using that measure, no support was found for either Brown or Hays: there is no statistical association between saliency and binomiality for names of Samoan breadfruit cultivars. It could be argued that the restricted taxonomic focus (i.e., only breadfruit cultivars are considered) makes our study an inadequate analysis of the broader theory. However, by restricting ourselves to a single crop, "intensity of cultural use" (Turner 1988) is held constant, so our data on comparative saliency are strictly comparable. Studies on other crop cultivars in various places would add considerable power to this basic approach.

Our data also gave partial support for the argument that there is often considerable disagreement among indigenous societies on folk names. Working with the Wola, an agricultural people in New Guinea, Sillitoe (1980) found that they hold in common a set of cultivar names, but when forced to apply these names to actual plants, they only agreed about 50% of the time about which name goes with which plant. He surmised that disagreement over naming plants most likely occurs at this taxonomic level since such identifications frequently depend on fine details of morphological variation (Sillitoe 1995).

Although some slight differences in the use of monomial or full binomial names were noted (as might be expected when attempting to clarify a plant name for a foreign investigator), there was surprising little variation in plant names, once cognates with superficial differences were clumped together in the analysis. What surprised us further was not the differences in names, but the overall consensus in names which were recorded on islands over 400 km apart. The number of idiosyncratic responses, including those we surmise were invented on the spot to please a persistent investigator, was very low. Fewer than one percent of our interviews were excluded from analysis because of idiosyncrasy. In all settings, however, two broadly different realms of ethnobotanical knowledge were found: common knowledge and expert knowledge.

A useful outcome of our study was that we were able to statistically quantify what makes an individual an expert. Future ethnobotanical fieldwork in Samoa will be greatly facilitated by our having defined a large group of experts with whom we can work and conduct in-depth interviews about breadfruit. For example, we will work with some of these experts to ascertain the conservation status of breadfruit cultivars in Samoa, especially those that were only known by one or a few individuals. We surmise that cultivars such as ***ma'afala*** and ***puou***, known by 90% and 81%, respectively, of the Samoans interviewed are common in cultivation and therefore conserved *in situ,* whereas the more uncommon cultivars may be at risk and require special conservation strategies.

A rigorous comparison between folk and statistical measures of expertise is beyond the scope of this paper, but we believe that our statistical definition of expert could benefit investigators conducting ethnobotanical projects elsewhere. It is possible in a fairly short time to interview a large number of people about a specific topic and from that group quickly and accurately identify those who possess expert knowledge about the subject at hand. Working primarily with expert individuals is a useful, and timely, strategy to maximize obtaining reliable, specialized, and verifiable information. In our sample, 17 of the experts were in their 60s and six were over 70 years old. It is critical that the traditional cultural

knowledge of these elderly experts, several of whom were in very poor health, be documented before it is lost.

Place of residency has a strong impact on the amount of knowledge about breadfruit names that an individual possesses (Table 5). As might be expected, the traditional villages of Saipipi and Falealupo on the remote island of Savai'i score highest in breadfruit knowledge. We were surprised to find that Ofu and Olosega villages in the remote Manu'a archipelago of American Samoa scored at about the same rate as the residents of the capital cities of Pago Pago and Apia. This may be due to the prevalence of sending high school age boys and girls off-island for education, where they are removed from participating in daily cultural activities and hence do not have the opportunity to learn traditional knowledge and practices from their elders. There is, in effect, a brain drain as adults leave the Manu'a islands for Tutuila, Hawaii, or the U.S. mainland. For example, many families maintain residences both in Ofu or Olosega and on the island of Tutuila. Mid-life adults are working in the wage economy on Tutuila, providing a home for their high-school-attending children, or caring for their elderly parents who have moved to Pago Pago for medical care and long-term convalescence. The mayor of Olosega suggested that since the residents of Ofu and Olosega rely primarily on earned income and family remittances rather than subsistence agriculture, there is little need to keep such breadfruit knowledge alive. In any case, it appears that ethnotaxonomic knowledge is exceedingly fragile, and can quickly disappear, even from apparently remote areas. This is evident by the low rate of knowledge possessed by expatriate Samoans.

Gender differences in breadfruit knowledge can be supposed to reflect the gender-based divisions of labor inherent in Samoan society. Men are more likely to work in the plantations, plant and harvest breadfruit, and prepare them in the ***umu*** or stone ovens. It is important to note that these gender differences, while reflected in the mean and median number of names known by men and women, do not reflect expert knowledge. The second most knowledgeable person about breadfruit names was a woman. In the group of 60 individuals we defined as having expert knowledge, 23 were women and 37 were men. Knowledge about breadfruit among this group of women can primarily be attributed to transmission of knowledge by family traditions. For example, some of these women held ***matai*** titles that are conferred by their families and typically recognize those individuals who are knowledgeable about and practice ***fa'asamoa***—i.e., who maintain traditional Samoan customs and knowledge. Several women were related by marriage and/or birth to ***matai***. If there are no sons living in the household a daughter, out of respect for her father, will become familiar with and learn her family's traditions, including areas of expertise that are normally associated with men. Wives of ***matai*** bring to the marriage their own family traditions and often learn those of their husbands. Upon the death of a ***matai***, wives are the repository of this shared knowledge and ensure that both families' traditions are perpetuated.

In interviews with individuals who work in administration of government and NGO conservation programs in Apia, a modest level of breadfruit knowledge was recorded; certainly above the median (8.5 vs. 6.0 names) for all of our respondents, but below that of the expert level. One individual reported 15 names,

placing him well within the expert range, while a long-term expatriate knew only five names. The expert noted that his knowledge was acquired principally from his residence in and subsequent visits to remote villages. This suggests that villagers who possess strong ethnotaxonomic knowledge should be recruited to oversee conservation and agrobiodiversity programs in Samoa and elsewhere. Indigenous knowledge of crop diversity is crucial to guiding conservation and agricultural development projects to ensure that traditional cultivars, cultivation practices, and cultural practices and knowledge are preserved rather than eroded.

NOTES

[1] Herbarium specimens were deposited at PTBG, National Tropical Botanical Garden, Kalaheo, Hawaii.

[2] The standard orthography for Samoan includes a glottal stop or break, indicated here by an apostrophe before the vowel.

[3] Interview with Vaiga Uaealesi, in Saipipi Village, Savai'i, 19 July 2000.

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